



## News Release

**United States Navy**

Space and Naval Warfare Systems Command  
Public Affairs and Corporate Communications  
4301 Pacific Highway, San Diego CA 92110-3127  
Telephone: 619-524-3432 FAX: 619-524-3469

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### SPAWAR Accepts GFO MetOc Satellite from Ball Aerospace



**SAN DIEGO** — The Space and Naval Warfare Systems Command has formally accepted the GEOSAT Follow-On meteorological and oceanographic satellite for operational use.

“We are incorporating the GFO data into the oceanographic models for the Fleet,” said Captain Charlie Hopkins, SPAWAR Meteorological and Oceanographic System’s program manager. “I am pleased that we are able to provide our customer – the Fleet user – a better product with GFO.”

The Naval Satellite Operations Center (NAVSOC) has been providing the telemetry, tracking, and commanding support to the GFO spacecraft since its launch in February 1998 from Vandenberg Air Force Base, Calif. “The NAVSOC team of military, civil service and contractor personnel is proud to have been part of the government-industry team that solved the problems that delayed spacecraft acceptance,” said Mike Crawford, technical director, NAVSOC. “After the upcoming operational transfer of GFO from SPAWAR to Naval Space Command, NAVSOC will continue cost-effective and reliable satellite operations providing valuable data to the oceanographic and meteorological communities for many years to come.”

Ball Aerospace & Technologies Corp built the GeoSat Follow-On satellite for SPAWAR to transmit precise oceanographic information directly to ships at sea and to Navy facilities on the shore. The compact and lightweight graphite composite satellite weighs 761 pounds unfueled and measures approximately 10 feet in length. The data from the five-year mission is intended to enhance the effectiveness of Navy weapon and sensor systems. The satellite uses a radar altimeter and a water vapor radiometer to precisely measure the subtle differences in sea-surface height associated with ocean currents and eddies. The altimeter also provides information about wave height, wind speed and glacier ice.

After the commercial launch atop an Orbital Sciences Corporation Taurus rocket, the GFO spacecraft encountered intermittent and periodic resets of its flight computer and problems with its global positioning system. A time-consuming series of software uploads resolved the computer-reset problem. However, the GPS system did not produce operationally acceptable precision orbits and the GFO mission was revised to rely on satellite laser ranging instead of an on-board system for the navigation precision required for operational use.

“Finally, there is an opportunity for GFO to take its place alongside the world-class altimeters used by the scientific community,” said Len Andreozzi, GFO program manager at Ball Aerospace.

Ball Aerospace built the spacecraft bus, procured the payload – consisting of an altimeter, radiometer, Doppler beacon and GPS system – procured commercial launch services, and supplied the system software and

hardware for the two ground support stations. The company also provided the integrated antenna for the altimeter and radiometer as well as the GPS and communications antennas.

“There was a time that many probably wondered if they would ever see valid data from GFO,” Captain Hopkins added. “During the initial calibration-validation period, we had a problem with the spacecraft CPU resetting on its own. Ball Aerospace and Technology applied its resources to this very technical problem, and eventually fixed it. Then, the GFO Team of industry, academic, and government professionals worked together to find and fix other anomalies. This all took time as we collected data over a 34-day period, analyzed it, and made adjustments—about three months from start to finish.”

“We had to complete a two-exact-repeat orbit period for data collection and any glitch during either of the two 17-day periods meant we started the analyze, adjust, test, upload, and observe process again,” he said.

“Once we had the CPU reset issue resolved, we hoped but failed to have the same level of success with the on-board GPS system that was not delivering position data and time,” Captain Hopkins said. “The team never was able to obtain the precision orbit or timing we needed with the onboard system, but we got lucky. We implemented a ground-based laser range finding solution with NASA’s help, and Ball Aerospace and Technology added a ground time system similar to that used for the original GEOSAT.”

In addition to transmitting the data directly to Navy ships, GFO stores global data and passes it via remote receiving stations to the Naval Oceanographic Office (NAVOCEANO). The altimeter information is used to improve NAVOCEANO’s ability to analyze and forecast the state of the ocean. Once the data is received from NAVOCEANO, the National Oceanic and Atmospheric Administration is responsible for its distribution to the civil and scientific communities. The GFO satellite is controlled by the NAVSOC in California.

“The GFO team has succeeded in delivering a highly sophisticated on-orbit capability at a relatively low cost,” stated Jay Berkowitz, SPAWAR’s MetOc Systems deputy program manager. “GFO was considered a high-risk program. Ball agreed to share this risk through unique performance incentives and cost sharing. Achieving what we did for \$85 million was truly remarkable, especially when compared to programs that used more traditional procedures,” Berkowitz said.

“Savings were achieved by an innovative approach to how the Navy did business. The Navy kept costs low by using specifications that emphasized what Navy needed and not imposing standards that had little value. The prime contractor, Ball, was asked to deliver an on orbit capability, not just a satellite. Their biggest challenge was to deliver GFO as a small satellite. Ball packaged GFO to fit on Orbital’s low cost Taurus launch vehicle,” Mr. Berkowitz added.

Ball Aerospace & Technologies Corp. provides imaging and communications products for commercial and government customers worldwide and is a subsidiary of Ball Corporation.

SPAWAR provides the warfighter with knowledge superiority by developing, delivering, and maintaining effective, capable and integrated command, control, communications, computer, intelligence and surveillance systems. SPAWAR provides information technology and space systems for today’s Navy and Defense Department activities while planning and designing for the future. SPAWAR is on the Web at <http://www.spawar.navy.mil>

**For more information contact:**

Mr. Richard Williamson, Space & Naval Warfare Systems Command Public Affairs and Corporate Communications Office, San Diego, California 619-524-3432 or [williamr@spawar.navy.mil](mailto:williamr@spawar.navy.mil)  
Barbara Darling, Media Relations, Ball Aerospace & Technologies Corp., 303-939-6010 [bldarling@ball.com](mailto:bldarling@ball.com)

A high-resolution image of the GFO at BATC is available at: <http://www.ball.com/aerospace/media/gfo.html>  
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